125686-5 is a Continuation in Part of
125686-1

WHAT IS CLAIMED IS:

1. A method for protecting an article from a high temperature, oxidative environment, said method comprising:

providing a substrate;

providing an ion plasma deposition target, said target comprising

from about 2 atom percent to about 25 atom percent chromium, and

the balance comprising aluminum; and

depositing a protective coating onto said substrate using said target in an ion plasma deposition process.

2. The method of claim 1, wherein providing said target comprises providing a target further comprising a material selected from the group consisting of zirconium, hafnium, tantalum, silicon, yttrium, titanium, lanthanum, cerium, carbon, boron, and combinations thereof.

3. The method of claim 2, wherein providing said target comprises providing a target further comprising up to about 4 atom percent of a material selected from the group consisting of zirconium, hafnium, tantalum, silicon, yttrium, titanium, lanthanum, cerium, and combinations thereof; and up to about 0.2 percent of a material selected from the group consisting of carbon, boron, and combinations thereof.

4. The method of claim 3, wherein providing said target comprises providing a target comprising

about 9 atom percent chromium,

about 1 atom percent zirconium, and

the balance comprising aluminum.

5. The method of claim 3, wherein providing said target comprises providing a target comprising

about 9 atom percent chromium,

about 1 atom percent zirconium,

about 2 atom percent tantalum, and

the balance comprising aluminum.

6. The method of claim 3, wherein providing said target comprises providing a target comprising

about 9 atom percent chromium,
about 1.5 atom percent hafnium,
about 1.5 atom percent silicon, and
at least about 85 atom percent aluminum.

7. The method of claim 1, further comprising:
coating said substrate with a metal layer prior to depositing said protective coating.

8. The method of claim 7, wherein coating said substrate with a metal layer comprises coating said substrate with a metal layer comprising at least one of platinum, palladium, nickel, and cobalt.

9. The method of claim 8, further comprising:
heat treating said substrate after coating said substrate with said metal layer.

10. The method of claim 9, wherein heat treating comprises heating said substrate to a temperature in the range from about 900°C to about 1200°C for a time in the range from about 30 minutes to about 8 hours.

11. The method of claim7, wherein coating said substrate with a metal layer comprises coating with a layer having a thickness in the range from about 2 micrometers to about 25 micrometers.

12. The method of claim11, wherein coating said substrate with a metal layer comprises coating with a layer having a thickness in the range from about 2 micrometers to about 6 micrometers.

13. The method of claim 1, further comprising heat treating said substrate after depositing said protective coating.

14. The method of claim 13, wherein heat treating comprises heating said substrate to a temperature in the range from about 700°C to about 1200°C for a time in the range from about 30 minutes to about 8 hours.

15. The method of claim 1, wherein providing said substrate comprises providing at least one of a nickel alloy, an iron alloy, and a cobalt alloy.

16. The method of claim 15, wherein providing said substrate comprises providing a superalloy.

17. The method of claim 16, wherein providing said superalloy comprises providing a component for service in a hot gas path of a gas turbine assembly.

18. The method of claim 1, wherein providing a substrate comprises providing a substrate comprising at least one coating.

19. The method of claim 1, wherein providing said ion plasma deposition target comprises providing a target manufactured using at least one of casting and powder metallurgy processing.

20. The method of claim 1, wherein depositing said protective coating onto said substrate further comprises applying a negative potential bias to said substrate.

21. The method of claim 20, wherein applying said negative potential bias comprises applying a potential bias in the range from about –10 volts to about –1000 volts.

22. The method of claim 21, wherein applying said negative potential bias comprises applying a potential bias in the range from about –50 volts to about –250 volts.

23. The method of claim 1, wherein depositing said protective coating onto said substrate further comprises grounding said substrate.

24. The method of claim1, wherein depositing said protective coating comprises depositing a protective coating having a thickness in the range from about 5 micrometers to about 250 micrometers.

25. The method of claim 24, wherein depositing said protective coating comprises depositing a protective coating having a thickness in the range from about 25 micrometers to about 75 micrometers.

26. The method of claim 1, further comprising coating said protective layer with a thermal barrier coating.

27. The method of claim 26, wherein coating said protective layer with a thermal barrier coating comprises coating said protective layer with a thermal barrier coating comprising yttria-stabilized zirconia.

28. The method of claim 1, wherein depositing said protective coating comprises forming a protective coating comprising at least 80 volume percent of a single phase.

29. The method of claim 28, wherein depositing said protective coating comprises forming a protective coating comprising at least 80 volume percent of a B2-structured aluminide intermetallic phase.

30. The method of claim 1, wherein depositing said protective coating comprises forming a protective coating comprising at least two phases.

31. The method of claim 30, wherein depositing said protective coating comprises forming a protective coating comprising a B2-structured aluminide intermetallic phase and platinum aluminide ($PtAl_2$).

32. A method for protecting an article from a high temperature, oxidative environment, said method comprising:

providing a substrate comprising a nickel-based superalloy;

providing an ion plasma deposition target, said target comprising

from about 2 atom percent to about 25 atom percent chromium,

up to about 4 atom percent of a material selected from the group consisting of zirconium, hafnium, tantalum, silicon, yttrium, titanium, lanthanum, cerium, and combinations thereof,

up to about 0.2 percent of a material selected from the group consisting of carbon, boron, and combinations thereof, and

at least about 70 atom percent aluminum;

depositing a protective coating onto said substrate using said target in an ion plasma deposition process, wherein a negative potential bias is applied to said substrate during deposition of said protective coating; and

heat treating said substrate after depositing said protective coating;

wherein after heat treating, said protective coating comprises a B2-structured aluminide intermetallic phase.

33. The method of claim 32, further comprising:

coating said substrate with a metal layer comprising at least one of platinum, palladium, nickel, and cobalt; and

heat treating said substrate after coating said substrate with said metal layer.

34. An alloy comprising:

from about 2 atom percent to about 25 atom percent chromium;

up to about 4 atom percent of a material selected from the group consisting of zirconium, hafnium, tantalum, silicon, yttrium, titanium, lanthanum, cerium, and combinations thereof;

up to about 0.2 percent of a material selected from the group consisting of carbon, boron, and combinations thereof; and

at least about 70 atom percent aluminum.

35. The alloy of claim 34, wherein said alloy comprises at least about 80 atom percent aluminum.

36. The alloy of claim 35, wherein said alloy comprises at least about 85 atom percent aluminum.

37. The alloy of claim 34, wherein said alloy comprises:

about 9 atom percent chromium;

about 1 atom percent zirconium; and

at least about 85 atom percent aluminum.

38. The alloy of claim 34, wherein said alloy comprises:

about 9 atom percent chromium;

about 1 atom percent zirconium;

about 2 atom percent tantalum; and

at least about 85 atom percent aluminum.

39. The alloy of claim 34, wherein said alloy comprises:

about 9 atom percent chromium;

about 1.5 atom percent hafnium;

about 1.5 atom percent silicon; and

at least about 85 atom percent aluminum.

40. A target for use in an ion plasma deposition process, said target comprising:

an alloy comprising

from about 2 atom percent to about 25 atom percent chromium,

up to about 4 atom percent of a material selected from the group consisting of zirconium, hafnium, tantalum, silicon, yttrium, titanium, lanthanum, cerium, and combinations thereof,

up to about 0.2 percent of a material selected from the group consisting of carbon, boron, and combinations thereof, and

at least about 70 atom percent aluminum.

41. An article for use in a high temperature, oxidative environment, comprising:

a substrate; and

a coating disposed over said substrate, said coating comprising

from about 2 atom percent to about 25 atom percent chromium,

up to about 4 atom percent of a material selected from the group consisting of zirconium, hafnium, tantalum, silicon, yttrium, titanium, lanthanum, cerium, and combinations thereof,

up to about 0.2 percent of a material selected from the group consisting of carbon, boron, and combinations thereof, and

at least about 70 atom percent aluminum.